# Chapter 6

## IMPLEMENTATION

This document has been prepared as a planning and analysis study. It was developed with the idea that it would be used in the analysis of actual transportation planning and policy questions. It is for this reason that the project has generated more than 130 data files. These files are intended for use in the analysis of the economic and planning questions. It may not be immediately apparent how the implementation of the research findings here should occur. It is the purpose of the present chapter to make this explicit.

### Use of Results for Economic Analysis

The appendices of this report include several project-generated databases that should be useful to organizations interested in the flow of goods into, through, and out of the counties and urban areas governed by metropolitan planning organizations (MPOs) of Indiana. Naturally, these appendices contain data of interest to Indiana state government in its analysis of economic problems as well. The data presented here will enable an Indiana county, or MPO, or the State, to evaluate its exports (productions) and imports (attractions) for any one or all of 19 different commodity groupings. These 19 groups include more than 93% of the value or tonnage of these goods for the state. This should be useful in answering questions about potential economic development initiatives or in examining attributes of the economic base for the areas of interest. These production and attraction tables are in tons, but they can easily be converted to dollars by multiplying the tons by the national values of Table 4.5, or by using comparable Indiana values on the following page. Indiana values were not used in this study since shipments that terminate in Indiana are often valued at the origin. For economic analysis it might be desirable to use the dollar valuation nationally for imports and the Indiana dollar valuation for exports (see Table 6.1).

The above analyses would indicate whether the area under examination was a net importer or exporter of the 19 groups of commodities examined here simply by subtracting the imports from the exports.

Table 6.1 Indiana Commodity Value per Ton

| Commodity STCC | Value per Ton |
|---|---|
| 01 | $145.21 |
| 11 | 26.11 |
| 14 | 8.07 |
| 20 | 806.03 |
| 22 | 2,957.99 |
| 23 | 14,095.84 |
| 24 | 783.10 |
| 25 | 4,250.68 |
| 26 | 1,135.04 |
| 28 | 959.61 |
| 29 | 144.13 |
| 32 | 125.07 |
| 33 | 627.13 |
| 34 | 2,266.62 |
| 35 | 9,290.32 |
| 36 | 8,336.30 |
| 37 | 5,110.83 |
| 40 | 157.13 |
| 50 | 6,004.13 |

Comparative analyses with other areas would enable a county or MPO to make some inferences with regard to the types of industries that the local area can support. If a neighboring county has a substantial proportion of its exports in the transportation equipment area and the county of interest has better transport facilities and cheaper labor, this may suggest the direction that economic development should take. Of course there are many other problems that might be of interest that could be addressed by the use of the production and attraction tables.

Other economic questions might make use of the total flows generated by this study. The productions and attractions noted above are distributed to origins and destinations and a file is created that gives the identification number of one of the 145 origins followed by the identification number of one of the 145 destinations. These numbers are followed by the tonnage of the good being transported and (in some cases) the length of shipment. These files can be used to generate data on modes used in the shipment and as a result help to identify the economic importance of one of the modes, e.g., given the nature of the traffic, does it matter whether a county continues to have rail service?

The above discussion has obviously been couched in terms of counties or MPOs, but the same types of questions and analyses can be undertaken by agencies of state government where appropriate.

## Use of Results for Transport Analysis

The transport questions that can be addressed by the findings of this study fall into two broad classes: questions related to transport planning and questions related to transport policy. There may be some planning questions at the county level that can be answered using the data of this study. There probably aren't very many of these since this study was undertaken at the county level, i.e., a county is simply a node here. There would be more problems at the multi-county or MPO level, and even more at the state level. The planning questions would require the use of the geographic information system (GIS) that has been used throughout this research, TransCAD, in part because the data are compatible with that GIS and in part because TransCAD contains numerous applications that are useful for transport planning.

Typical of the questions that could be analyzed are the corridor improvement questions of interest to MPOs. For example, the data here could be used by an MPO to evaluate the traffic impacts of constructing a bypass around an urban area. Such projects are usually undertaken to divert through traffic away from the downtown in order to lessen congestion. The flows generated here went to considerable difficulty to estimate these through flows as an element of the total flows generated.

Analysis of such a problem would involve assigning the traffic to a transport network similar to the state network used here. The flows external to the MPO could be consolidated at stations surrounding the region of interest. One would have to digitize the "bypass link" as part of the network, and give it attribute data such as travel time, speed limits, and length (if this is not automatically calculated by the GIS). This would be followed by possible modifications of the former central route and a reassignment of the traffic to the new network. This would give a fairly good idea of the traffic that would be diverted by the construction of the bypass route. It would not completely answer the question of traffic volume changes between the two routes because we have not included local (intracounty) traffic in this analysis. That is, an individual supplier might go from a plant in one part of the county to a plant in another part of the county, never leaving the county. These are simply intracounty flows and their origins and destinations within the county are unknown. In addition, we have also not included any flows of a personal nature. These are being developed by a different study.

Utilizing exactly the same general approach state transportation planners could undertake an analysis of the traffic reduction or speed improvements resulting from the construction of a new highway or improving an existing highway between two cities in the state. Local traffic is not of much interest in such situations and there is interest in whether the new facility would move the traffic better. One would have to follow the aforementioned steps of digitizing in the new route, coding its attributes, and assigning and reassigning traffic.

This study includes commodity traffic estimates for 1993, 2005 and 2015. In the event that one wants to initiate a study using 1997 data these values could be interpolated by calculating the average annual increase (or decrease) in traffic and adding four times this value to the 1993 flow estimate. For a 1999 study six times the value would be added, and so forth. There are plans at the federal level to redo the 1993 survey in 1998. If that occurs this study could be updated by the state. However, even if the 1998 survey is undertaken, it may be 2002 before the results of the survey are available. Some of the results from 1993 are still unavailable in the middle of 1997.

## Use of the Results for Transport Policy Formulation

State transport policy is the position that the State takes with regard to certain issues. Some of the state's policies are reflected in its statutes, e.g., it is the policy of the State of Indiana to provide financial support for public transit, or to provide loans to short line railroads, while other policies are given by its rules or regulations, e.g., speed limits on the state's highways. In many cases the state does not have a transport policy and it may initiate different studies to assist it in these cases.

If the state has an interest in knowing whether it should encourage further rail abandonment in the interest of economic efficiency for the rail carriers or whether it should discourage such activities, the databases developed as part of this project could provide some insight in the development of a policy covering such situations. The design of the study would involve examining current branch line operations and assuming that they would be abandoned. Of course the traffic would still reach its destination, but it would most likely have to be trucked the distance from a retained rail station to its destination. Similarly, outbound traffic would have to be trucked to the nearest retained rail station for transport. One could add attributes to the highway link file of the GIS to reflect damage per motor carrier axle, actual transport cost, and so forth. This design is being discussed within the context of a single line, but all potential abandonment candidates could be analyzed to give the basis for a comprehensive state policy toward abandonment.

Policy studies often have to be repeated because the state must function in a very dynamic context. For example, the state's rail abandonment policy of the 1970s may no longer be an acceptable policy, since much of the over-capitalization that existed in that physical plant has been abandoned. Therefore, there is always a need to update policy as situations change.

## Completeness of the Database

The completeness of the database developed needs further clarification even though this has been discussed at several points in this study. The objective here was to model commodity flows between Indiana's counties and the rest of the United States. There are no trips to work, school, or shop included here. These are personal traffic flows, and they are being developed by a parallel project being undertaken by Cambridge Systematics. Also missing here are flows by service vehicles, e.g., tow trucks. While the movement of lumber to a given county is included here, its intracounty movement to a job site or a home is excluded. The movement of mail into a county is included, its delivery to your home is not. The movement of garbage from your county to the landfill is included here, its pickup in front of your house is not. The point is that counties and urban centers within counties generate a significant amount of what is called commercial traffic and this traffic is not examined here as traffic assigned to the county highway network because that was beyond the scope of the study. It is ironic that the transportation planning process has been in existence for half a century, but we have never developed a methodology for assigning the intrazonal (here the intracounty) traffic to the zonal (county) network.

These statements regarding what is included and what is not included in the database are important because all too often there is a tendency to go beyond the data. This is a relatively complete data set of intercounty - interstate commodity flows for Indiana's counties and states of the United States, no more and no less.

## Deliverables

Aside from this report the major deliverables from this project are flow vectors and/or matrices of different types. There is a basic interest in the production and attraction vectors developed for the 19 commodities and two types of mail service examined here. There is also an interest in the total flow, but it would be of little value as a tonnage since it would contain some very heterogeneous commodities. As a result, Appendix A contains productions and attractions of the commodities and mail expressed in annual tons. These 21 sets of productions and attractions are given for 1993 (Appendix A), 2005 (Appendix E), and 2015 (Appendix F).

The second set of databases developed and presented here are the various proportions used in modal assignments of different types of commodity shipments. These are presented in Appendix B as proportions of traffic assigned to the various modes for specific commodities and several classes of shipping distances. Given the commodity and length of shipment these tables can be used to identify the modes that will be used in distributing the good. The source of these data is the tons of goods shipped by mode as presented in the United States summary volume of the 1993 Commodity Flow Survey. The tons have been converted in every case to proportions from the original data. National data were used (as opposed to Indiana data) because this study examined all flows in the country in arriving at the flows for Indiana. There are 19 tables reflecting these modal choices for 1993. The assumption is that these remain constant into the future and therefore the patterns observed in 1993 are assumed to hold for 2005 and 2015. Mail and express mail are not included in these data. It is assumed that these are flown into the state and distributed to counties by motor carriers.

Appendix C contains the major computer programs used in this study. There were probably more than thirty programs written for this project, but the appendix contains only the most useful of these. The programs included are:

> GUNNAR5. This program takes the productions and attractions and an average length of shipment and distributes flows between origins and destinations using a gravity model that constrains the length of shipments, flows from origins and flows to destinations in such a way that the generated values are equal to the initial values. This is often called a fully-constrained gravity model.
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> GUNIN. This program is essentially the GUNNAR5 program with the exception that it calculates the length of commodity specific shipments originating in Indiana for comparison with published data on this average length from the commodity flow survey.
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> NEWMODE. This program takes a commodity as distributed by GUNNAR5, i.e., where the origin, destination, flow, and distance are generated as output, and assigns these to specific modes. It uses the data of Appendix B (although in a slightly different format) for this assignment.

ALLOHWY. This program takes the tonnage flows assigned to the Highway mode by NEWMODE and using commodity density and commodity value, it generates flow matrices in truck loads and the dollar value of these.

ALLORWY. This program works the same as ALLOHWY except that it generates flow matrices of rail cars and the dollar value of these.

GROWTH. This program takes the production and attraction vectors for total tonnage by commodity and expands these based on expected growth in population, manufacturing, mining, or agriculture, as appropriate, for 2005 and 2015.

NEWFLOWS. This program takes the future flows and the parameters from the gravity model of 1993 and distributes flows for future time periods (2005 and 2015 here). This yields a set of flows which may be subjected to NEWMODE, ALLOHWY, and ALLORWY to forecast flows between the 145 areal units used here.

All of the above programs are written in FORTRAN and can easily be modified for analysis of the traffic of any state. Most of the inputs in this report, e.g., commodity density, commodity value, modal proportions, could be used for other states.

The flow (origin-destination) matrices derived here for 1993 by GUNNAR5 and for 2005 and 2015 by NEWFLOWS are listed in Appendix D. They are not reproduced here since they would generate thousands of pages of output. They are being presented to the state on 100 MB diskettes. These are the matrices that can be subjected to different traffic assignment routines under different assumptions.